a2

(referred to in this example as image data) are input to Qbit and Motion Flag recovery circuit 10. The Qbit and Motion Flag recovery circuit 10 generates hypotheses~~, referred to herein as candidate hypotheses, of~~ for a ~~possible~~ number of quantization bits (Qbit) used and motion flag (MF) possible values. As will be described in more detail below, a score is generated with respect to each hypothesis and the hypothesis with the best score, e.g., minimum score, is selected as the recovered values. The data decoded using the selected hypothesis is output as the decoded data to the memory 30.

Please replace the following paragraph on page 8, line 4:

The scores and error flags corresponding to data decoded using the selected hypothesis is input to error propagation detection circuit 20. As will be discussed below, error propagation detection circuit 20 evaluates ~~candidate~~ hypotheses to generate ~~candidate~~ hypotheses results used to detect error propagation. In one embodiment, circuit 20 examines the score distribution and detects error propagation due to false candidate decoding. Other evaluation techniques may be used, including evaluation of score distribution patterns or other metrics. Pixel error recovery block 40, receives the decoded data error flags as well as flags that may have been generated by the error propagation detection circuit 20 to indicate that pixel error recovery is warranted and performs a pixel error recovery process to recover pixel data that may not be correct due to error propagation.

Please replace the following paragraph on page 9, line 4:

a3

An alternate embodiment is illustrated by **Figure 1c**. In this embodiment, the bitstream of data is input into decoder 70 and candidate decoder 72. The decoder 70 decodes those portions of the bitstream that are decodable using standard available decoding processes, i.e., portions containing no errors. Candidate decoder 72 generates candidate decodings and selects a best candidate decoding as discussed herein. Error propagation detection circuit 74 detects errors which occur due to error propagation, for example, those errors caused by selection of an incorrect candidate decoding. ——The prevent degradation circuit 76 receives the decoded data output by decoder 70 and error propagation flags generated by error propagation detection circuit 74 and performs block

a3 cont

processing to recover blocks of data flagged to have errors. In one embodiment, block processing estimates block data using neighboring block data. Other block processing techniques may be used.

Please replace the following paragraph on page 12, line 3:

a4

Referring back to **Figure 2**, the error measures are input to scoring circuit 210 which determines which hypothesis generates the best score. A variety of techniques can be used to determine the best score. For example, confidence weighted scoring, majority based scoring, simple accumulation based scoring and majority decision scoring can be used. In one embodiment the score is determined as follows:

$$score(i) = \sum_j G\left(\frac{m(i,j) - \min(j)}{m(i,j) + \min(j)}\right)$$

where m(i, j) represents the j-th measurement for hypothesis i for the block or block group (e.g., 3 blocks which form a group), min(j) is the minimum of the j-th measurement among different hypotheses, and G() is an identity function or a monotonically increasing function, depending on the application. G may be selected to be a function that increases the sensitivity of the scoring such that incorrect hypotheses will be clearly distinguishable from the correct hypothesis. For example, a square or linear function may be used. Alternately, G may be a constant, including one having a value of unity.

Please replace the following paragraph on page 13, line 5:

a5

Figure 4 illustrates one embodiment of a circuit to determine the best score. In this embodiment, the error measures, e.g., linear error 0-5 are respectively input to function G[·]0 to G[·]5 405, 407, 409, 411, 413, 415. The minimum score as detected by circuit 420 can also be input to functions G[·]0 to G[·]5 and the values output are summed by adder logic 421, 423, 425, 427, 429, 431 to produce scores Score(0) to Score(5). In this embodiment, the minimum value determined by minimum circuit 435 is identified as the best score.

a5 con't

Please replace the following paragraph on page 13, line 12:

Referring back to **Figure 2**, the best score is input to the selectors 215 and 220 which respectively output decoded data of the selected hypotheses corresponding to the best score (to memory 225) and error flags identified with particular portions of the decoded data decoded according to the selected hypothesis.

Please replace the following paragraph on page 14, line 1:

a6

Whenever the selected hypothesis is wrong, scores are very similar among ~~candidate~~ hypotheses. The threshold point can be selected such that all incorrect recovery results are surely detected. Typically, such a threshold also results in a few false alarms, i.e., some correct recovery results are detected as incorrect (shown as the shaded area in **Figure 6**), and a subsequent error recovery process such as the pixel recovery process below, is used to recover the corresponding pixels. **Figure 6** further illustrates a proper threshold selection.

Please replace the following paragraph on page 14, line 12:

a7

In one embodiment, score distributions in successive recoveries are used to reinforce the error detection decision. Given that the current hypothesis is correct, the recovery start point of a next block or group of blocks in the bitstream is also correct. If the start point is correct, ~~candidate~~ hypotheses for subsequent blocks or groups of blocks will generate pixels that exhibit highly correlated properties with respect to neighboring blocks resulting in large score distributions. If the start point is incorrect, ~~candidate~~ hypotheses for subsequent blocks or group of blocks will generate pixels that are uncorrelated with the neighboring pixels resulting in uncorrelated score distributions.

Please replace the following paragraph on page 15, line 3:

a8

The likelihood that the hypothesis with the best score is correct may be indicated by the score distribution *sd(i)* among ~~candidate~~ hypotheses. The score distribution can be measured in terms of statistics of various order, including standard deviation, average, median, difference of best score and second best score, difference of best score and average of best scores, etc. A score distribution may be chosen so that the score

distribution curve for the correct recovery is completely non-overlapping with the score distribution curve for incorrect recovery.

a8 con't

Please replace the following paragraph on page 15, line 11:

A measurement criterion can be chosen that is highly sensitive to scoring variation among ~~candidate~~ hypothesis. The optimal choice depends on the measurement and scoring techniques used in conjunction with the parameter, i.e., Qbit and Motion Flag, recovery technique as well as the type of data, for example, audio or video.

Please replace the following paragraph on page 22, line 6:

a10

For further information regarding classified adaptive error recovery, see U.S. Patent Application Serial No. 6,307,979, titled "Classified Adaptive Error Recovery Method and Apparatus", filed concurrently herewith, and is herewith incorporated by reference.

Please replace ~~the~~ following paragraph on page 18, line 7:

a9

Figure 9 illustrates one embodiment of a process for recovering data, and in particular for detecting error propagation in a bitstream of data. At step 905 the start point of a block or group of blocks is identified. If an error is found in the bitstream corresponding to that start point (step 910), a recovery process is initiated to provide candidate decodings at step 915. For example, in one embodiment candidate decodings of Motion Flag and Qbit data may be generated based upon specified parameters. At step 920, each hypothesis is scored and the candidate with the best score is selected, step 925. The score distribution sd, is measured at step 930.

Please replace the following paragraph on page 44, line 3:

a11

The present invention provides a mechanism for preventing quality degradation of decoded data during the decoding of encoded data. In one embodiment, error propagation is detected and corresponding data is flagged. An error recovery process is then applied to the flagged data. In an alternate embodiment, scores for ~~candidate~~ hypotheses are calculated for lost/damaged data. A score distribution is used for detection of the false

a!! cont

~~candidate~~ hypotheses. The data are flagged if their score distribution is within a range defined by a threshold and an error recovery process is applied to recover those data having associated error flags set.